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ABSTRACT

Risk factors associated with the unsuccessful discharge from a secondary-level therapeutic day treatment program of students with serious emotional/behavioral disorders (E/BD) were studied. The use of epidemiologic analysis as a program evaluation method was also investigated by comparing risks associated with identified characteristics of the E/BD population to program completion status. Results from a sample of 134 E/BD students indicated significant differences in successful program completion related to individual variables, specifically student substance abuse and involvement with Juvenile Services. It was also found that the additive effects of several variable pairs greatly increased the risk of unsuccessful program outcomes. The variable pairs identified as relating to the highest risk of unsuccessful outcomes, as high as seven times more likely to be unsuccessful, included being: (1) female and Caucasian; (2) female and truant; (3) female and a substance abuser; (4) female and involved with Juvenile Services; (5) Black and male; (6) Caucasian and a substance abuser; (7) Caucasian and involved with Juvenile Services; and (8) truant and a substance abuser. Implications for E/BD program development and epidemiologic analysis are explored. (Contains 4 tables and 21 references.) (Author/SLD)

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Running Head: AERA: Epidemiology Evaluations

# Application of Epidemiology to an Outcome Based Evaluation of an Educational Program Serving Emotionally/Behaviorally Disturbed Students

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## Abstract

The purpose of this study was to identify risk factors associated with unsuccessful discharge status of students with serious emotional/behavioral disorders (E/BD) from a secondary level, therapeutic day treatment program. In addition, this article describes and demonstrates the effective use of epidemiologic analysis as a program evaluation method by comparing risks associated with identified characteristics of the E/BD population to program completion status.

Results indicated significant differences in successful program completion related to individual variables, specifically student substance abuse and involvement with Juvenile Services. Further, we found that additive effects of several variable pairs greatly increased the risk of unsuccessful program outcomes. The variable pairs identified to relate to the highest risk of unsuccessful outcomes (between three and seven times more likely) included (a) female and Caucasian, (b) female and truant, (c) female and substance abuse, (d) female and Juvenile Services involvement, (e) Black and male, (f) Caucasian and substance abuse, (g) Caucasian and Juvenile Services involvement, and (h) truant and substance abuse.

Implications for E/BD program development and ongoing program evaluation with epidemiologic analysis were addressed.

# Application of Epidemiology to an Outcome Based Evaluation of an Educational Program Serving Emotionally Disturbed Students

The prevalence of behaviorally/emotionally disturbed (B/ED) school-aged children identified as needing services in the United States was estimated to be 3 to 6 percent in 1989 (National Mental Health Association [NMHA], 1993). The education of youth with serious emotional and behavioral disorders (E/BD) is considered one of the most difficult challenges facing our schools today. Much of our existing programming is inadequate, with students with E/BD having the least positive outcomes of any group of children with disabilities (Lichtenstein, 1988; NMHA, 1993; Sitlington, Frank, & Carson, 1990). The school success of students with E/BD is unsatisfactory as these students are reported to have the highest dropout rate of any group of children with disabilities (Lichtenstein, 1988). National surveys indicate that the dropout rate for students with E/BD is currently 50%, with only 39% actually earning diplomas. Moreover, the students with E/BD who remain in school are found to have lower grades and fail more often than any other students (NMHA, 1993). These students are also more likely, than any other students with disabilities to be placed in restrictive settings (NMHA, 1993; United States Department of Education, 1993).

In the quest for information relevant to serving at-risk

populations, educational researchers have pursued multidimensional models using multivariate statistics which have yielded few concrete results. The answers provided in the literature are generally neither clear nor easily understood. Instead, educational programs serving target populations of challenged students have a need to know which variables identify students as being at-risk for successful or unsuccessful outcome from their programs. With this information, program developers and administrators would be able to identify and intervene early in an at-risk student's enrollment to better the student's chances of success. Further, such data serve to provide descriptive formative and summative evaluation information regarding a program's past or current performance standards relative to the population being served. The problem with such data, however, resides in the methods of analysis and dissemination to practioners.

The field of epidemiology has recently been edging its way into the social sciences. It has become a useful tool in basic applied developmental research (Carran & Scott, 1992) by presenting simple answers to practitioner's questions.

The purpose of this paper is to present the results of a developmental epidemiological analysis to quantify risk factors associated with unsuccessful completion of a day treatment program serving students with E/BD in a segregated facility. This analysis addresses the process of identifying, analyzing, and interpreting the risk factors associated with poor outcome,

for use as a program evaluation tool.

Epidemiology

Epidemiology is defined as "The study of the distribution and determinants of health-related states and events in populations, and the application of this study to control of health problems." (Last, 1983, p. 33). This is a very broad definition for a methodology which has been used as a tool for description, intervention, and evaluation of biological states around the world. Since Sir John Snow (1813 - 1858) wrote the first definitive text on epidemiology and made an explicit statement of germ theory transmission (30 years before it was discovered by Koch), there have been many definitions. In the past 50 years the definition has broadened from concern with communicable disease epidemics to take in all phenomena related to the health of a population.

There are four fields of study in Epidemiology: (a) analytic; (b) descriptive; (c) experimental; and (d) developmental. Each will be defined and discussed.

Analytic epidemiology is a type of hypothesis testing study to investigate causative factors related to a disease or dependent variable. An example of analytic epidemiology which has recently been in the media is the study of the long term effect of exposure to the herbicide Agent Orange. The hypothesis being tested was the relationship between the Agent Orange toxin and the prevalence of cancer. Using a Case-Control design, investigators identified Viet Namn Armed Forces service personnel

exposed to the Agent Orange toxin (cases) and service personnel serving in Viet Namn at the same time who had not been exposed to the toxin (controls). These individuals were tracked to determine their current health status. The number of cases with cancer were compared to the number of controls with cancer, and calculations were performed to determine the relationship between the Agent Orange toxin and the prevalence of cancer.

Descriptive epidemiology is probably the most easily recognizable form of epidemiology, and the form that makes the papers most often. This field of epidemiology describes the occurrence of disease in a population: person, place, and time. Descriptive epidemiology determines what caused some of the people at the picnic to get sick; the trail back to the potato salad or the shrimp salad. It was the technique used to track down the contaminated and undercooked hamburger which killed a number of people last summer in the upper northwest United States. It is the tool of choice used by Public Health Officials since it is specifically targeted to an outcome, uses personal interview techniques, and generally arrives at a remediable conclusion.

The third type of epidemiology is Experimental epidemiology. As its name implies, this is a rigidly controlled and detailed experimental study procedure which generally takes place in randomized controlled trials. Drug trials are the best exemplars. When the National Institute of Health (NIH) tests a new cancer drug, a sample population is identified and qualified.

The drug is administered to an experimental group whose biological results are then compared to a control group.

The fourth type of epidemiology is Developmental epidemiology, which investigates the distribution of behavioral outcomes in infancy and childhood and the indicators of their occurrence. Scott, Shaw, and Urbano (in press) present a succinct and effective description of developmental epidemiology linking birth certificate data to later educational disabilities. Numerical values were calculated for the relationship between birth characteristics (i.e., birth weight, socio economic status, etc...) and the prevalence of educational disabilities and called risk factors. The numerical value of risk factors represents the influence of the risk factor variable on the outcome. A discussion of the concept and implications of risk are necessary to explain the relevance of developmental epidemiology to program evaluation.

Epidemiological Conceptual Terms.

Risk Analysis. Risk is defined as the probability that an event will occur (Last, 1983). To calculate risk estimates, the researcher must first select the dichotomous event to investigate. In this study, the outcome is program completion and is categorized as poor vs. good. The next step involves a definition of the means by which the probability will be measured, typically as one or more identified variables which are described as present or absent. The presence or absence of each variable is then compared to the occurrence of the event,

indicating the likelihood of the event occurring relative to the targeted variables.

As Table 1 shows, developmental epidemiology is a method of 2 x 2 categorical data analysis which enables outcome measures to be calculated in terms of indices of risk. A risk factor, then, is defined as an identified variable which is associated with an increased probability of a specified poor outcome, in this case the unsuccessful completion of a program. This does not imply a causal relationship. Rather, the variable is considered to be an indicator of this increased risk for poor outcome. (For a more detailed discussion of risk see Carran & Scott, 1992).

Once a risk factor is identified, the following information may be determined through simple calculations; (a) What proportion of subjects in the total sample were identified as having the predictor variable present? and (b) Of the subjects determined to have experienced a poor outcome, what proportion were identified as having the predictor variable present? The answers to these two questions are easily answered by stratifying the data according to Table 1 and then calculating the Exposure Frequency (EF) and Exposure Odds Ratio (OR), respectively (see Table 1 for calculation formulas).

Epidemiologic analysis is not a complicated model that relies upon theoretical relationships estimated through complicated analyses. Rather, it is easy to apply to any situation, and analysis/interpretation of the data are straightforward. Like any good evaluation tool, it forces the

evaluator to select specific target outcomes, quantify the outcomes, and then compare the occurrence of the outcome between levels of a predictor variable. It is critical to point out, however, that the results of this type of analysis are dependent upon the reliability and validity of the outcome variable.

Additive Model of Interaction. The assessment of risk in epidemiology is based on the sufficient-component causal model. In this model there are sufficient causes for an outcome to occur; some causes are known, others remain to be discovered and are not considered random in occurrence. These sufficient causes are typically a combination of more than one agent. Each sufficient cause is considered to be independent in the sense that it can act alone, or it may interact with other agents. Thus, a developmental disability could be due to a single sufficient cause (i.e. LBW) or due to the single sufficient cause (poverty), or due to the interaction of these two factors. this is the Additive Model of Interaction. This will almost always be the case for developmental outcome; combinations of agents, exposures, and personal characteristics that occur in life experience.

Epidemiologic Evaluation Cycle. Epidemiologic analysis can be used as a cyclical evaluation tool by implementing an analysis-intervention-analysis assessment schedule. Researchers, program developers, and teachers alike can calculate risk estimates for a wide variety of situations, design interventions intended to reduce risk for individuals with specific

characteristics, and then reassess the risk levels at a later point in time. This evaluation tool will be discussed in depth using results from this paper.

Selected Risk Characteristics of SED Adolescents

The first step in determining factors related to E/BD program outcomes was the identification of characteristics most likely to be risk factors. Based on a review of the literature on characteristics of adolescents with E/BD, we selected five risk variables for investigation of their impact upon outcome: juvenile services involvement, truancy, substance abuse, gender, and ethnicity. The relation of each to adolescents with E/BD is briefly summarized.

Truancy. Truancy has a significant negative impact on students since it interferes with the delivery of educational services and may be a precursor to the development of later psychological difficulties (Schultz, 1987). In addition, attendance in school has been shown to be directly related to program completion and likelihood of dropping out in students with disabilities (United States Department of Education, 1992; 1993). Truants are more likely to engage in delinquent activities and deviant behaviors while not attending school, run away from home, and score below other non-attenders on measures of school achievement (Galloway, 1983; Robbins & Ratcliff, 1980). In addition, Zieman and Benson (1980; 1981) found a gender difference in the reasons and concerns for truancy in adolescents, suggesting the possibility of differential rates and

outcomes for males and females. Since attendance has been identified as a factor in successful E/BD program completion of students in a psychoeducational treatment facility (Leone, Fitzmartin, Stetson, & Foster, 1986), truancy may impede successful program completion.

Juvenile Services Involvement. Involvement by children and adolescents in the Juvenile Services Administration system indicates delinquent or criminal behavior on the part of the child. A common diagnostic category among behaviorally disordered adolescents, especially juvenile offenders, is conduct disorder (Kutcher et al., 1989; Wierson, Forehand & Frame, 1992). It has been postulated by several theorists that delinquent behavior is a higher order form of conduct disorder, with the offenses being more severe (Loeber, 1990; Patterson, DeBaryske, & Ramsey, 1989; Thornberry, 1987).

Substance Abuse. A number of recent studies found a significant relationship between emotional/behavioral disorders and substance abuse in psychiatric adolescent samples (Bukstein, Glancy & Kaminer, 1992; Kutcher, Marton, & Korenblum, 1989). Neighbors, Kempton, and Forehand (1992) found that the diagnosis of abuse or dependence on alcohol or drugs was associated with a diagnosis of conduct disorder in over 90% of the sample; a co-diagnosis of depression and anxiety occurred in 38% and 30% of the sample, respectively. When polysubstance abuse was present (alcohol and drugs), the probability of having more than one of the three diagnoses (conduct disorder, depression, or anxiety)

was above 50%.

In relation to program outcomes, alcohol and substance abuse were found to be associated with program success and failure for adolescents with E/BD in a vocational training and placement program (Bullis et al., 1994).

Gender and Ethnicity. These two variables were necessarily included, since established research has demonstrated various degrees of association with outcomes for students with disabilities. Wagner (1992), in a synthesis of findings from the National Longitudinal Transition Study, concluded that females with disabilities in secondary special education tended to be more seriously impaired than males with disabilities.

The variable of ethnicity has been one of the most controversial issues in special education. Overrepresentation of minority students in special education classes has been documented (Finn, 1982) and litigated (Larry P. v. Riles, 1979).

## Method

### Sample

The subjects in this study were 134 students identified as E/BD and received services in a secondary level, therapeutic day treatment program in a state approved, nonpublic, special education facility. A description of this facility follows. Since 1988, student records at this facility have been entered into a database which included demographic, educational, psychological, and parental/social characteristics of all students.

According to archival records and database information, of the 258 students who attended this facility, a total of 134 students have been discharged to date. Of those, 47 were discharged successfully and 87 unsuccessfully. Successful discharges were considered to include graduation, certificate of completion, or transition into a regular classroom setting. Unsuccessful discharges included assault/aggressiveness, drug related dismissal, failed senior year, long term hospitalization, insufficient progress/lack of effort, pregnancy related withdrawal, refusal to attend/poor attendance/dropped out, withdrawn by parent, withdrawn by self, and more restrictive environment required. Students who moved were not included in this sample.

The discharged student population was 78% male and 22% female; the ethnic background of students was 35% minority (Black, Hispanic, and Indian) and 65% Caucasian. The average number of prior school placements, before coming to the educational facility, was 3.84 (SD = 2.19). The average age at admission was 16.14 years (SD = 2.65) and the average grade at admission 7.69 (SD = 1.89). The average grade at discharge was 8.67 (SD = 2.16) and the average time enrolled in the educational facility was 1.81 years (SD = 1.58).

Setting

The setting was a therapeutic educational treatment facility serving adolescents with E/BD. All of the students served at the facility were referred and funded by local public schools.

Students enrolled in this facility met each of the following criteria: (a) had a primary diagnosis of severe emotional disturbance; (b) were in at least 6th grade upon referral (program includes grades 6 - 12); (c) had verbal IQs greater than or equal to 80 or achievement scores no more than two years behind expected grade level in reading and math; (d) were not in need of physical containment, nor homicidal, nor a threat to the community, and (e) had no previous conviction for distribution or possession with intent to distribute a controlled substance. Services provided in this setting included: (a) peer mediation; (b) state student assistant program; (c) behavior management system; (d) individual therapy once a week; (e) family therapy; (f) drug and substance abuse counseling; (g) art therapy; (h) music therapy; and (i) psychodrama therapy.

Outcome Variable

Since the purpose of the study was to identify and quantify risk factors related to unsuccessful outcome for students with E/BD, the outcome variable selected for examination was unsuccessful program discharge. For purposes of this paper, successful discharge (SD) was defined as a 'good' outcome and unsuccessful discharge (UD) as a 'poor' outcome. The analyses described below investigated which variables were associated with UD, or 'poor' outcome.

Predictor Variables

Five variables were selected as predictor variables for investigation, based on their potential relationship to student

discharge status and their documentation in school records. Selected variables included Juvenile Services involvement, truancy, gender, and ethnicity.

This type of epidemiologic analysis required that predictor variables be dichotomous, modifications of some variables were required. The variable of ethnicity was restricted to Black and Caucasian students only. Six students of other ethnic backgrounds were not included in the data set, which reduced the total number of subjects included in the study to 128.

Students were identified as 'yes' for truancy if they had been truant (more than 9% unexcused absences) prior to admission to this facility or while enrolled in this facility. A rating of 'yes' for the variable of student substance abuse was documented through a student's educational records, a counselor's report, or reference to hospitalization for substance abuse. Juvenile services involvement was documented through educational records, although the exact nature of the involvement was not available.

Analyses

Two sets of data analyses were conducted. The first set, univariate analyses, provided the risk of unsuccessful discharge (UD) for each of the predictor variables. The second set of data analyses included the calculated values of the additive effects of pairs of predictor variables on the outcome variable of UD. Both the univariate and additive analyses required the computation and interpretation of two measures, the Exposure Frequency and the Odds Ratio.

Exposure Frequency. What proportion of subjects in the total sample were identified as having the predictor variable? In order to examine the importance or weight of the relative risk estimates provided by epidemiologic analysis, one needs to consider the value of risk relative to the proportion of subjects in the total sample who possessed the variable. Thus the calculation of the frequency of the occurrence of the variable, or the Exposure Frequency (EF), may be used as a descriptive and interpretive tool, reflecting the occurrence of the predictor variable in the sample. If few subjects had the predictor variable present, the resulting low EF may indicate a low prevalence or relatively rare variable, or may indicate a sampling error. Likewise, a high occurrence may also indicate high prevalence or a sampling error. The EF informs the researcher of the rate at which the variable occurs in the sample and aids in interpretation of the Odds Ratio.

Odds Ratio. Of the subjects determined to have experienced a poor outcome, what proportion were identified as having the predictor variable? The calculation of the Odds Ratio (OR) is made to determine the likelihood, or odds, that a discrete outcome (UD v. SD) is associated with a specific level of a predictor variable (present v. absent). The OR is the ratio of the occurrence of the discrete outcome of interest when the level of the predictor variable is present compared to the discrete outcome when the level of the predictor variable is absent. An interpretation may then be made regarding the elevated risk of

the discrete outcome when the level of the risk variable is present.

The analytic concept of risk is quantified by a numerical value representing degree of at-risk status. An OR greater than 1.00 would indicate a positive association, or an increased risk of poor outcome among those exposed to the predictor variable. Conversely, if the OR were less than 1.00, an inverse relationship would be determined to exist between the predictor variable and outcome. Thus, an OR calculated to equal 1.4, would be interpreted to mean that the risk of unsuccessful discharge is 40 percent (i.e., 1.4 minus the null value of 1.0) higher in students identified as 'yes' for substance abuse compared to students who have been identified as 'no' for substance abuse. Further, an OR equal to 2.0 indicates that subjects with the risk variable present are 100 percent (i.e., 2.0 minus 1.0), or 2 times more likely to experience a poor outcome compared to subjects without the risk variable (Henneckens & Burning, 1987).

The OR calculation is a statement of probability of outcome, with magnitude implying strength of association and degree of risk status. Therefore, an OR states the probability of an outcome in one group (risk variable present) as compared to a second group (risk variable absent). For example, if an OR is equal to 2.0 for unsuccessful outcome in students identified as 'yes' for substance abuse, this indicates that students identified as 'yes' for substance abuse are 2 times more likely to have experienced unsuccessful discharge in comparison to

students identified as 'no' for substance abuse. This value is not interpreted using a criterion of level of significance (i.e., $p < .05$). Instead, any value greater than 1.0 represents an elevated risk status. For this study, all ORs will be reported; however, since there were so many variables with computed ORs greater than 1.00, only ORs greater than 2.0 will be presented as an elevated risk status.

As discussed above, it is important to interpret the OR in consideration of the EF level. If the EF is small, only a small number of the sample have experienced the variable. A low EF with a correspondingly low OR should not necessarily be interpreted to indicate a poor predictor variable; rather, the low EF may indicate the need for a larger sample. In contrast, however, if the EF is small and the estimated risk OR is large, this indicates that the variable has a dramatic impact when present, even in a small portion of the sample.

## Results

### Univariate Analyses

Two types of univariate analyses are presented in Table 2, descriptive and epidemiologic. Descriptive chi-square analyses were performed on each predictor variable testing relationships with the outcome variable of discharge. This was done to provide the reader with a familiar statistical test for a criterion reference. Significant differences were found for the variables Juvenile Services and Student Substance Abuse with the presence of affirmative involvement for either variable related to UD (see

Table 2 for chi-square values). Nearly 80 percent of students who were involved with Juvenile Services had UD outcomes and 85 percent of students identified or suspected of substance abuse were unsuccessfully discharged.

The epidemiological analysis results were similar to the chi-square findings. Juvenile Services and student substance abuse both had a low EF of near 20 percent in this sample, yet both had elevated Ors at 2.79 and 3.70, respectively. This indicates that even though the exposure of Juvenile Services and substance abuse involved less than a quarter of the entire sample, involvement with either one was associated with an elevated risk of UD from this program. In other words, the presence of any one of these predictor variables placed students at nearly a three times higher risk for not successfully completing the program compared to students who did not have these characteristics.

Additive Effects of Risk Factors

In an additive model, the combined effects of two risk factors are analyzed. One variable is selected for control and subjects with that variable present are subsampled from the population. Using the selected subsample, the other risk factor variables are each then put into the format of Table 1, the 2 x 2 criterion table, with the EF and OR calculated. In this type of analysis, specific indicators of one risk factor are controlled by selecting only subjects from the sample who have that characteristic. Then the additive effect of a second risk factor

may be determined by examining the occurrence of levels of the second risk factor in the select sample and calculating an EF and OR. Despite the individual effects of a risk factor as estimated in the univariate analysis, the additive effect of a second risk factor to a specific level of the first variable may reveal surprising effects as two characteristics are combined. The results of the additive effects of combined risk factors are found in Table 3 and will be discussed in order of gender, ethnicity, Juvenile Services, truancy, and substance abuse.

Gender. The first section of Table 3 examined the additive effects of the other predictor variables for female subjects. Results of this analysis found Caucasian female subjects were nearly 7 times more likely to have an UD than Black female subjects. The EF indicates that ethnicity was not skewed, since there were 55% Caucasian and 45% Black females. Similarly, females who were also truant were nearly 7 times more likely to have UD (EF = 55%), compared to females who were not truant.

Other additive variables for female subjects which increased the risk of UD were substance abuse (OR = 5.5; EF = 21%) and Juvenile Services involvement (OR = 3.38; EF = 14%). Of special significance is the fact that, when female subjects were involved with either of these variables, the outcome was always UD. While the EF of both Substance Abuse and Juvenile Services were low, 21% and 14% respectively, both were demonstrated to be definitive of unsuccessful discharge for female students.

When male students were examined, the additive effect of

other predictor variables were not as negative as for females. Elevated risk was found only for male subjects who were involved with substance abuse (OR = 2.50; EF = 20%) or Juvenile Services (OR = 2.07; EF = 26%). Both of these variables had relatively low Efs, therefore, these variables should be considered as strong risk indicators for UD. Males who came from two non-birth parent families were also at an elevated risk (OR = 2.69), but the EF was very large (EF = 75%), urging caution in interpretation.

Ethnicity. When the discharge status of Black students was examined in the additive model, the only elevated risk was found for Black male students. These students were 3 times more likely (OR = 3.05; EF = 71%) to have an unsuccessful discharge than Black female students. As shown in Table 3, there was little identifiable risk associated with the other predictor variables for African-American students.

Caucasian students, however, were found to be at substantially greater risk for UD when additive risk factors were computed. As identified through the gender analysis described above, Caucasian female students were at an elevated risk for UD (OR = 2.32; EF = 20%) compared to Caucasian male students. Regardless of gender, Caucasian students who had been involved with substance abuse (OR = 5.54) or Juvenile Services (OR = 4.06) were clearly at high risk, as evidenced by the high OR relative to the low EF. This indicates that while only approximately 25% of the Caucasian subjects had these characteristics, these

students had significantly poorer outcomes than students without the variable. The final elevated risk factor for Caucasian students was family living status (OR = 3.08; EF = 75%).

Juvenile Services. Looking at the additive effect of the other risk variables for students who were involved with Juvenile Services indicated that Caucasian students who had Juvenile Services involvement were at a higher risk for UD (OR = 4.50; EF = 75%) than Black students with Juvenile Services involvement. In addition, students who had been involved with Juvenile Services and abused were at an elevated risk (OR = 2.00; EF = 46%) compared to those involved with Juvenile Services but not abused.

Truant. Students who had been identified as being truant either before or following admission had an elevated risk of UD if they were involved with substance abuse (OR = 3.25) or if they were female (OR = 3.01) . Both of these additive variable combinations evidenced relatively low Efs, 30% and 29% respectively, which highlights the importance of these characteristics relative to program outcome.

Substance Abuse. Students identified or suspected of substance abuse were at greatest risk for UD if they were Caucasian (OR = 4.50; EF = 77%). In the univariate analysis, substance abuse was significantly related to poor outcome, with 85% of students with this characteristic having UD. In the additive models presented earlier in this section, this variable was also shown to increase the risk of poor outcome for gender,

ethnicity, and truancy.

Summary. The additive effects of the combined risk factors of gender, ethnicity, Juvenile Services involvement, truancy, and substance abuse yielded several variable pairs which produced extremely elevated levels of risk related to poor outcome, UD, in this program. Table 4 presents a summary of selected variable pairs with three to seven times greater risk for UD, prioritized in order of greatest risk elevation. These and other selected findings will be discussed.

## Discussion

The results of this study identified several risk factors associated with poor outcome in an educational program for children and adolescents with behavior disorders. Univariate risk factors related to unsuccessful completion of the program were Juvenile Services involvement and student substance abuse. The additive relationships of the risk variables was more informative.

Gender differences were found for additive risk factors of UD. Females who were also truant were at elevated risk of UD compared to females who were not truant; truancy did not have an additive effect upon risk status for males, which was less than 1.00.

Ethnic differences related to gender were very informative. Caucasian students were at elevated risk for UD compared to Black students (OR = 1.60); however, when the additive effect of gender was controlled, only Caucasian Females were shown to be a high

risk group (OR = 6.93). As the EF indicates, the frequencies of Black and Caucasian females were similar and indicated no skew. Interpretation is, however, speculative for this sample.

Ethnic differences were found for the additive variables of Juvenile Services and substance abuse. Caucasian students with either of these characteristics were at 4 and 5 times the risk of UD; Black students with either of these characteristics were found to be at slight risk for UD. Efs were lower in the Black sample for these risks, indicating limited involvement.

Results of this investigation are applicable to the outcome selected for the specific facility under investigation. In this case, it has been demonstrated that students with E/BD served in one therapeutic treatment facility who have selected characteristics have an elevated risk of poor outcome compared to students without selected characteristics. The results of the epidemiological analysis is situational specific to this program, and caution regarding external validity is urged.

In the program evaluated in this study, the data suggested that female truants needed greater attention from the program planners and administrators. Response to this analysis is currently being implemented in the setting where the data was collected.

When female students have an unexcused absence, a phone call is made to the student's home to inquire about their absence. A phone call is also made to the student's parents. If the pattern of unexcused absences continues, the school arranges for a parent

conference to discuss the student's truancy problems. This is a daily routine.

The school staff have been vigilant about students' attendance in school. This attempt to reduce truancy will hopefully swing the OR of outcome toward successful discharge. This determination will be made with annual evaluation of the outcome status and relation to the risk variables.

In summary, epidemiologic analysis affords practitioners and program developers the opportunity to investigate the correlation of risk characteristics and program effectiveness. In this study, risk factors have been identified and quantified. The outcome variable has been specified and quantified. Findings provide specific information on subpopulations which require modifications or alternative interventions. After programmatic interventions have been devised and implemented, new odds ratios may be compared to the prior odds ratios, looking for change. If the new odds ratios calculations and exposure frequencies are smaller than the prior ones, this may indicate a decrease in the number of UD (poor outcome) students, indicating support for the program change implemented. To confirm the validity of the findings, however, data from sequential years should be analyzed and programmatic changes documented.

Other programs may have similar or dissimilar findings based on specific program elements. As described above, this seeming limitation underscores the usefulness of epidemiologic analysis as a simple program evaluation tool which provides customized,

readily useful information to practitioners. Despite concurrence of this study's with other studies' findings, additional evaluations of programs serving similar populations are recommended to assess the generalizability of these findings and to begin to identify specific program elements related to successful or unsuccessful outcomes for students. Further, epidemiologic analysis may enable cross-program comparisons related to specific outcomes for subpopulations and may provide data to assist with placement decisions for the very heterogeneous group of students identified as seriously emotionally disturbed.

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Table 1

Predictor-Criterion 2 x 2 Table.

| Predictor Variable | Criterion (outcome) | | |
|---|---|---|---|
| | Poor (UD) | Good (SD) | Total |
| Level 1 (poor) | A True Positive | B False Positive | $M_1$ |
| Level 2 (good) | C False Negative | D True Negative | $M_2$ |
| Total | $N_1$ | $N_2$ | $N_T$ |

Note. UD = Unsuccessful Discharge; SD = Successful Discharge

**Epidemiologic Formulas**

Exposure Frequency (EF) = $M_1 / N_T$

Odds Ratio (OR) = (A / C) / (B / D) = AD / BC

Table 2

Frequency Counts of Outcome Variable and Epidemiologic Calculations for Predictor Variables.

| Predictor Variables | Discharge Status | | | | Epidemiologic Analysis | |
|---|---|---|---|---|---|---|
| | UD | | SD | | | |
| | N | (%) | N | (%) | EF | OR |
| Total Subjects | 83 | (65) | 45 | (35) | | |
| Gender | | | | | | |
| Female | 18 | (62) | 11 | (38) | .22 | 0.86 |
| Male | 64 | (65) | 34 | (35) | .78 | 1.15 |
| Ethnicity | | | | | | |
| White | 57 | (69) | 26 | (31) | .65 | 1.60 |
| African-American | 26 | (58) | 19 | (42) | .35 | 0.62 |
| Juvenile Services Administration Involvement[1] | | | | | | |
| Yes | 22 | (79) | 6 | (21) | .24 | 2.79 |
| None | 50 | (57) | 38 | (43) | | |
| Student Substance Abuse[2] | | | | | | |
| Yes | 22 | (85) | 4 | (15) | .20 | 3.70 |
| None | 61 | (60) | 41 | (40) | | |
| Truancy | | | | | | |
| Yes | 37 | (66) | 19 | (34) | .45 | 1.11 |
| No | 44 | (64) | 25 | (36) | | |

[1] $x^2(1, N=116)=4.27$, $p < .05$
[2] $x^2(1, N=128)=5.59$, $p < .05$

Note. UD = Unsuccessful Discharge; SD = Successful Discharge; EF = Exposure Frequency; OR = Odds Ratio.

Table 3

The Additive Relation of Paired Risk Variables to Unsuccessful Discharge.

| Variables | Discharge Status | | Epidemiologic Analysis | |
|---|---|---|---|---|
| | UD | SD | | |
| | N | N | EF | OR |
| Female & Caucasian | 13 | 3 | .55 | 6.93 |
| Black | 5 | 8 | .45 | 0.14 |
| Female & JS (yes) | 4 | 0 | .14 | 3.38 |
| JS (no) | 13 | 11 | | |
| Female & Truant (yes) | 13 | 3 | .55 | 6.93 |
| Truant (no) | 5 | 8 | | |
| Female & SubAbuse (yes) | 6 | 0 | .21 | 5.50 |
| SubAbuse (no) | 12 | 11 | | |
| Male & Caucasian | 43 | 23 | .67 | 0.98 |
| Black | 21 | 11 | .33 | 1.02 |
| Male & JS (yes) | 17 | 6 | .26 | 2.07 |
| JS (no) | 37 | 27 | | |
| Male & Truant (yes) | 23 | 16 | .41 | 0.63 |
| Truant (no) | 39 | 17 | | |
| Male & SubAbuse (yes) | 16 | 4 | .20 | 2.50 |
| SubAbuse (no) | 48 | 30 | | |

Note. UD = Unsuccessful Discharge; SD = Successful Discharge; EF = Exposure Frequency; OR = Odds Ratio, JS = Juvenile Services involvement.

Table 3, cont.

| Variables | | Discharge Status UD N | SD N | Epidemiologic Analysis EF | OR |
|---|---|---|---|---|---|
| Black | & Female | 5 | 8 | .29 | 0.33 |
| | Male | 21 | 11 | .71 | 3.05 |
| Black | & JS (yes) | 4 | 3 | .18 | 1.25 |
| | JS (no) | 16 | 15 | | |
| Black | & Truant(yes) | 8 | 5 | .30 | 1.31 |
| | Truant (no) | 17 | 14 | | |
| Black | & SubAbuse(yes) | 4 | 2 | .13 | 1.54 |
| | SubAbuse (no) | 22 | 17 | | |
| Caucasian | & Female | 13 | 3 | .20 | 2.32 |
| | Male | 43 | 23 | .80 | 0.43 |
| Caucasian | & JS (yes) | 18 | 3 | .27 | 4.06 |
| | JS (no) | 34 | 23 | | |
| Caucasian | & Truant(yes) | 29 | 14 | .53 | 0.84 |
| | Truant (no) | 27 | 11 | | |
| Caucasian | & SubAbuse(yes) | 18 | 2 | .24 | 5.54 |
| | SubAbuse (no) | 39 | 24 | | |
| JS | & Female | 4 | 0 | .15 | 1.41 |
| | Male | 17 | 6 | .85 | 0.71 |
| JS | & Black | 4 | 3 | .25 | 0.22 |
| | Caucasian | 18 | 3 | .75 | 4.50 |
| JS | & Truant (yes) | 9 | 5 | .52 | 0.15 |
| | Truant (no) | 12 | 1 | | |
| JS | & SubAbuse (yes) | 5 | 2 | .25 | 0.59 |
| | SubAbuse (no) | 17 | 4 | | |

Table 3, cont.

| Variables | Discharge Status UD N | SD N | Epidemiologic Analysis EF | OR |
|---|---|---|---|---|
| Truant & Female | 13 | 3 | .29 | 3.01 |
| Male | 23 | 16 | .71 | 0.33 |
| Truant & Black | 8 | 5 | .23 | 0.77 |
| Caucasian | 29 | 14 | .77 | 1.29 |
| Truant & JS (yes) | 9 | 5 | .26 | 1.01 |
| JS (no) | 25 | 14 | | |
| Truant & SubAbuse (yes) | 14 | 3 | .30 | 3.25 |
| SubAbuse (no) | 23 | 16 | | |
| SubAbuse & Female | 6 | 0 | .23 | 1.50 |
| Male | 16 | 4 | .77 | 0.67 |
| SubAbuse & Black | 4 | 2 | .23 | 0.22 |
| Caucasian | 18 | 2 | .77 | 4.50 |
| SubAbuse & JS (yes) | 5 | 2 | .35 | 0.21 |
| JS (no) | 12 | 1 | | |
| SubAbuse & Truant (yes) | 14 | 3 | .65 | 0.58 |
| Truant (no) | 8 | 1 | | |

Table 4

Summary of Paired Risk Variables with Odd Ratios greater than 3.0.

| Variable Pairs | OR | EF |
|---|---|---|
| Female and Caucasian | 6.93 | .55 |
| Female and Truant | 6.93 | .55 |
| Caucasian and Substance Abuse | 5.54 | .24 |
| Female and Substance Abuse | 5.50 | .21 |
| Juvenile Services Involved and Caucasian | 4.50 | .77 |
| Female and Juvenile Services Involved | 3.38 | .13 |
| Truant and Substance Abuse | 3.25 | .31 |
| Black and Male | 3.05 | .71 |